

Control of Hazardous Energy (Lockout/Tagout)

OSHA Standard 29 CFR 1910.147

Overview

Workers performing service or maintenance on machinery and equipment are exposed to injuries from the unexpected energization, startup of the machinery or equipment, or release of stored energy in the equipment.

The Lockout/Tagout standard requires the adoption and implementation of practices and procedures to shut down equipment, isolate it from its energy source(s), and prevent the release of potentially hazardous energy while maintenance and servicing activities are being performed. It contains minimum performance requirements, and definitive criteria for establishing an effective program for the control of hazardous energy. However, employers have the flexibility to develop lockout/tagout programs that are suitable for their respective facilities.

This tutorial summarizes for you the key components of the standard in a "plain English" format. This tutorial is intended only to guide OSHA staff in understanding aspects of the Lockout/Tagout standard, not to substitute for compliance with the plain terms of the standard. Nothing in this tutorial is intended to diminish or otherwise affect OSHA's authority to enforce the requirements of section 1910.147 of the Act, nor is it intended to create any legally enforceable right or benefit in any person.

Scope and Application

Who does this standard apply to?

- General Industry workers performing servicing and maintenance on machines and equipment and who are exposed to the unexpected energization, startup, or release of hazardous energy.

What activities or operations are covered?

- Any source of mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.
- Constructing, installing, setting up, adjusting, inspecting, modifying, maintaining and/or servicing machines or equipment, including lubrication, cleaning or unjamming of machines or equipment, and making adjustments or tool changes, where employees could be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.
- Servicing and maintenance activities performed during normal production operations if:
 - An employee is required to remove or bypass machine guards or other safety devices, or
 - An employee is required to place any part of his or her body into a point of operation or into an area on a machine or piece of equipment where work is performed, or into the danger zone associated with the machine's operation.

Who does this standard not apply to?

- General Industry workers performing servicing and maintenance on machines or equipment who are NOT exposed to the unexpected energization or startup of the machines or equipment, or the release of hazardous energy.

What activities and operations are not covered?

- Servicing and maintenance of equipment performed during normal production operations if:
 - the safeguarding provisions of Subpart O, and other applicable general industry standards are effective in preventing worker exposure to hazards created by the unexpected energization or startup of machines or equipment, or the release of energy.
- Minor tool changes and adjustments, and other minor servicing activities that take place during normal production operations which are routine, repetitive, and integral to the use of that production equipment, as long as workers are effectively protected by alternative measures which provide effective machine safeguarding protection (See Subpart O).
- Construction, agriculture, and maritime workers
- Installations under the exclusive control of electric utilities for power generation, transmission, and distribution.
- Exposure to electrical hazards from work on, near, or with conductors or equipment in electric utilization installations.
- Oil and gas well drilling and servicing.
- Work on cord and plug connected electrical equipment, if:
 - The equipment is unplugged from the energy source and the authorized employee has exclusive control of the plug.
- Hot tap operations that involve transmission and distribution systems for gas, steam, water, or petroleum products on pressurized pipelines, if:
 - Continuity of service is essential, shutdown of the system is impractical, documented procedures are followed, and employees are effectively protected by special equipment.

Purpose

What is the purpose of the standard?

- To prevent the unexpected energization or startup of machines and equipment, or release of stored energy, in order to prevent workplace injuries during service and maintenance operations.

How is this accomplished?

- Employers must establish an energy control program, consisting of energy control procedures, employee training, and periodic inspections to ensure that before service and maintenance is performed, machines and equipment that could unexpectedly startup, become energized, or release stored energy, are isolated from their energy source(s) and rendered safe.

Definitions

What definitions are useful to understand how the lockout tagout standard will be applied?

- Authorized employee: An employee who locks or tags machines or equipment in order to perform servicing or maintenance.
- Affected employee: An employee who is required to use machines or equipment on which servicing is performed under the Lockout/Tagout standard or who performs other job responsibilities in an area where such servicing is performed.

- Other employees: All employees who are or may be in an area where energy control procedures may be utilized.
- Capable of being locked out: An energy-isolating device is considered capable of being locked out if it:
 - Is designed with a hasp or other means of attachment to which a lock can be affixed.
 - Has a locking mechanism built into it.
 - Can be locked without dismantling, rebuilding, or replacing the energy-isolating device or permanently altering its energy control capability.
- Energized: Machines and equipment are energized when they are connected to an energy source or they contain residual or stored energy.
- Energy-isolating device: A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: A manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.
- Energy source: Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.
- Lockout: The placement of a lockout device on an energy-isolating device, in accordance with an established procedure, ensuring that the energy-isolating device and the equipment being controlled cannot be operated until the lockout device is removed.
- Lockout device: Any device that uses positive means, such as a lock, blank flanges and bolted slip blinds, to hold an energy-isolating device in a safe position, thereby preventing the energizing of machinery or equipment.
- Normal production operations: Utilization of a machine or equipment to perform its intended production function.
- Servicing and/or maintenance: Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, maintaining and/or servicing machines or equipment, including lubrication, cleaning or unjamming of machines or equipment, and making adjustments or tool changes, where employees could be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.
- Tagout: The placement of a tagout device on an energy-isolating device, in accordance with an established procedure, to indicate that the energy-isolating device and the equipment being controlled may not be operated until the tagout device is removed.
- Tagout device: Any prominent warning device, such as a tag and a means of attachment, that can be securely fastened to an energy-isolating device to indicate that the machine or equipment to which it is attached may not be operated until the tagout device is removed.

Energy Control Program

What are the core components of the energy control program?

- Energy control procedures that detail and document the specific information that an authorized employee must know to accomplish lockout/tagout, namely, the scope, purpose, authorization rules and techniques to be utilized for the control of hazardous energy.

- Periodic inspections of the energy control procedures to ensure that the procedures and the requirements of the standard are being followed.

Employee training and retraining, along with additional training under a tagout system, to ensure that the purpose and function of the energy control programs are understood by the employer.

What is the intent of the energy control program?

- To ensure that before any employee services equipment where the potential exists for unexpected energization or start-up of equipment or the release of stored energy, the machine or equipment is isolated from the energy source and rendered inoperative.

Does the employer have the flexibility to develop his/her own program?

Yes. Employers are expected to develop programs and procedures, training and inspections, that meet the needs of their particular workplace and the particular types of machines and equipment they use and service as long as they meet the requirements of the standard.

Energy Control Procedures - Documentation

What is the employer's obligation in establishing energy control procedures?

Employers must:

- Develop, document and use specific procedures to control potentially hazardous energy when employees are servicing equipment or machinery.

Under what limited situations is documentation of the procedures not required?

- The machine or equipment has no potential for stored or residual energy, or for reaccumulation of stored energy after shut down, which could endanger employees.
- The machine or equipment has a single energy source that can be readily identified and isolated and the isolation and locking out of that energy source will completely deenergize and deactivate the machine or equipment.
- The machine or equipment is isolated from that energy source and locked out during servicing or maintenance.
- A single lockout device will achieve a locked-out condition.
- The lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance.
- The servicing or maintenance does not create hazards for other employees.
- The employer has had no incidents involving the unexpected activation or reenergization of machines or equipment during servicing or maintenance.

Energy Control Procedures - Required Content

What specific elements must be documented in the employer's energy control procedures?

- The procedures must outline the scope, purpose, authorization, rules and techniques that the employer will use to control hazardous energy.
- The procedures must state the means to be used to enforce compliance.

At a minimum, the procedures must include:

- A specific statement of the intended use of the procedure.
- Specific procedural steps for shutting down, isolating, blocking, and securing machines or equipment to control hazardous energy.
- Specific procedural steps for the placement, removal, and transfer of lockout devices or tagout devices, and a description of who has responsibility for them.
- Specific requirements for testing a machine or piece of equipment to determine and verify the effectiveness of lockout devices, tagout devices, and other energy control measures.

Periodic Inspection

What is the intent of the requirement for the employer to conduct periodic inspections?

To ensure that the energy control procedures continue to be implemented properly, that the employees are familiar with their responsibilities, and that any deviations or procedural inadequacies that are observed are corrected.

How often must the inspection take place?

At least annually.

Who performs the periodic inspection?

An authorized employee not involved in the energy control procedure being inspected.

What does the periodic inspection entail?

- The employer must identify any deficiencies or deviations and correct them.
- Where lockout is used, the inspector must review each authorized employee's responsibilities under the procedure with that employee (group meetings are acceptable).
- Where tagout is used, the inspector must review both the authorized and affected employee's responsibilities with those employees for the energy control procedure being inspected, and the additional training responsibilities of 1910.147(c)(7)(ii).
- The employer must certify that the periodic inspections have been performed.

What must the certification identify?

- Identify machine on which the procedure was utilized.
- Date of inspection.
- Identify the employees included in inspection.
- Identify person who performed the inspection.

Employee Training and Communication

Why must employees affected by this standard be trained?

- So that they understand the purpose and function of the energy control program.
- So that employees acquire the knowledge and skills necessary for the safe application, usage and removal of the energy controls.

The standard requires different levels of training for the three categories of employees; what are the differences in the training required for the three categories?

- Authorized employees must receive training on the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control.
- Affected employees must receive training on the purpose and use of the energy control procedure.
- Other employees (those whose work activities are or may be in an area where energy control procedures may be utilized) must be instructed about the procedure and about the prohibition relating to attempts to restart or reenergize machines or equipment that are locked out or tagged out.

Additional Training

What additional training is required when tagout systems are used?

Employers must train employees in the following limitations of tags:

- Tags are essentially warning devices affixed to energy isolating devices and do not provide the physical restraint on those devices that is provided by a lock.
- When a tag is attached to an energy isolating means, it is not to be removed without authorization and it is never to be bypassed, ignored, or otherwise defeated.
- Tags must be legible and understandable by all employees.
- Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.
- Tags may evoke a false sense of security and their meaning needs to be understood as part of the overall energy control program.
- Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

Employee Retraining

Who must be retrained?

All affected and authorized employees must be retrained under certain conditions listed below.

Is training required annually?

No.

What triggers the retraining requirements?

- A change in job assignments.
- A change in machines, equipment, or processes that present a new hazard.

- A change in the energy control procedures.
- Periodic inspections reveal that there are deviations in the energy control procedure.
- The employer believes that there are deviations from, or inadequacies in, the employee's knowledge or use of the energy control procedures.

What is the object of the retraining?

- To introduce new or revised control methods and procedures as necessary.
- To reestablish employee proficiency.

Does training require certification?

Yes. Employer must certify that training or retraining took place and that the employee is kept up to date.

What information must appear on the certificate?

- Each employee's name.
- The dates of training and /or retraining.

Lockout/Tagout

If an energy isolating device is not capable of being locked out, can the employer use a tagout system?

Yes, when the energy isolating devices are not lockable, tagout may be used, provided the employer complies with the provisions of the standard which require additional training and more rigorous periodic inspections.

If an energy isolating device is capable of being locked out, must the employer use a lock out system?

Yes. Unless the employer can show that the tagout system provides full employee protection, as described in paragraph (c)(3) of the standard.

New or Modified Equipment

What is the date after which all new machines and equipment, or all machines and equipment that undergo major repair, renovations or modification, must be equipped with energy-isolating devices capable of accepting a lockout device?

January 2, 1990.

Full Employee Protection

What are the requirements for the use of tagout devices when lockout devices are capable of being used?

- The tags are attached where the lockout devices would be.
- The employer demonstrates that the tagout will provide protection at least as effective as locks and will assure full employee protection.

How does an employer demonstrate that the protection achieved using the tagout program is equivalent to the level of safety obtained by using a lockout program?

The employer must comply with all tagout-related provisions and also use additional safety measures that provide a level of safety equivalent to that obtained by using lockout. This might include removing and isolating a circuit element, blocking a controlling switch, opening an extra disconnecting device, or removing a valve handle to reduce the potential for any inadvertent energization while the tags are attached.

Materials and Hardware

What protective materials and hardware must be provided by the employer for isolating, securing or blocking machines or equipment from energy sources?

- Locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware.

What are the requirements for the lockout and tagout devices?

- Must be durable, so that they are capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.
- Must be singularly identified.
- Must be the only devices used for controlling energy.
- Must not be used for other purposes.
- Must be standardized within the facility in at least one of the following criteria: color, shape, or size. Additionally, tagout devices must be standardized as to print and format.
- Must be identifiable, in that it indicates the identity of the employee applying the devices.

In addition to the above, what other hardware requirements are specific to lockout?

- Must be substantial enough to prevent removal without the use of excessive force or unusual techniques such as with the use of bolt cutters or other metal cutting tools.

In addition to the above, what other hardware requirements are specific to tagout?

- Must be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.
- Must not deteriorate when used in corrosive environments such as areas where acid and alkali chemicals are handled and stored.
- Must be standardized in print and format.
- Must be substantial to prevent inadvertent or accidental removal.
- Must have an attachment means of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and having the general design and basic characteristics of being at least equivalent to a one-piece all-environment-tolerant nylon cable tie.
- Must warn against hazardous conditions if the machine or equipment is energized.
- Must include a legend such as: Do Not Start, Do Not Open, Do Not Close, Do Not Energize, Do Not Operate.

Application of Energy Control

To safely apply energy control to machines or equipment (using either lockout or tagout devices), authorized employees must perform certain procedures, in a specific order. What are the sequential procedures?

- Preparation for shutdown: Before an authorized or affected employee turns off a machine or equipment, the authorized employee must have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.
- Machine or equipment shutdown: The machine or equipment must be turned off or shut down using the procedures established for it to avoid any additional or increased hazards to employees as a result of the machine or equipment stoppage.
- Machine or equipment isolation: All energy-isolating devices that are needed to control the machine's energy source must be located. These devices must then be used to isolate the machine or equipment from its energy source.
- Lockout or tagout device application: Lockout or tagout devices must be affixed to each energy-isolating device by authorized employees. Lockout devices when used, must be affixed in a manner that will hold the energy isolating devices in a "safe" or "off" position. Where tagout devices are used, it must be affixed in a manner that will clearly indicate that the operation or movement of energy isolating devices from the "safe" or "off" position is prohibited. If the tag can not be affixed directly to the energy isolating device, the tag must be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device
- Stored energy: After the energy-isolating device has been locked out or tagged out, all potentially hazardous stored or residual energy must be relieved, disconnected, restrained, or otherwise rendered safe.
- Verification of isolation: Before any work begins on machines or equipment that have been locked out or tagged out, an authorized employee must verify that the machine or equipment has been properly isolated and deenergized.

Release from Lockout/Tagout

The Lockout/Tagout standard includes requirements for releasing machines or equipment that have been locked out or tagged out prior to restoring energy to the equipment and using it. Before lockout or tagout devices are removed, and energy restored, what procedures must the authorized employee follow?

- Machine/equipment inspection: The work area must be inspected to ensure that nonessential items (e.g., tools, spare parts) have been removed and that all of the machine or equipment components are operationally intact.
- Positioning of employees: The work area must be checked to ensure that all employees have been safely positioned or have cleared the area. In addition, all affected employees must be notified that the lockout or tagout devices have been removed before the equipment is started.
- Lockout or tagout device removal: Each lockout or tagout device must be removed from the energy-isolating device by the employee who applied the device.

What is the unique circumstance that allows an employee other than the one who applied the lockout/tagout device to remove the device?

When the authorized employee who applied the lockout or tagout device is not available to remove it, that device may be removed under the direction of the employer, provided that specific procedures and training for such removal have been developed, documented, and incorporated into the employer's energy control

program.

What steps must the employer take if an employee, other than the one who applied the lockout/tagout device, removes the device?

- The employer must verify that the authorized employee who applied the device is not at the facility.
- The employer must make all reasonable efforts to contact the authorized employee to inform him/her that his/her lockout or tagout device has been removed.
- The employer must ensure that the authorized employees know that the lockout device has been removed before he/she resumes work at the facility.

Testing of Machines

When may lockout or tagout devices be removed temporarily?

In some circumstances, employees need to temporarily restore energy to a machine or piece of equipment during servicing or maintenance to test and /or reposition the machine or piece of equipment. Lockout or tagout devices may be removed temporarily in order to perform these tasks.

What sequence of action must occur in the temporary removal of the lockout/tagout devices?

1. The machine or equipment must be cleared of tools and materials.
2. Employees must be removed from the machine or equipment area.
3. All lockout or tagout devices may then be removed.
4. Authorized employees may then proceed to energize and test or position the equipment or machinery.
5. Following testing or positioning, all systems must be deenergized and energy control measures reapplied to continue the servicing and /or maintenance.

Outside Personnel (Contractors)

What are the obligations of the outside contractor and the on-site employer?

- Whenever contractors and other outside servicing personnel perform tasks covered by the Lockout/Tagout standard, they must adhere to all the standard's requirements.
- The contractor or outside employer and the on-site employer must inform each other of their respective energy control program responsibilities.
- The on-site employer must ensure that his/her employees understand and comply with the restrictions and prohibitions of the outside employer's energy control program.

Group Lockout/Tagout Requirements

Can servicing or maintenance be performed by a crew, department, or other group under this standard?

Yes. If they have been properly trained and the energy control program is followed.

What procedures must be followed that will offer group employees the same protection that the standard provides to individual employees?

- A group lockout/tagout must afford each employee a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.
- Primary responsibility for a set number of employees working under the protection of a group lockout or tagout device must be vested in a single authorized employee.
- The single authorized employee must determine the exposure status of individual group members.
- If there will be more than one crew, department, or group involved in the activity, a single authorized employee must be designated to coordinate affected workforces and to ensure continuity of protection.
- Each authorized employee must affix a personal lockout or tagout device to the machine or equipment when work begins and remove it when work is completed.

Shift and Personnel Changes

How is the continuity of lockout or tagout protection maintained during shift or personnel changes?

- Employers must ensure the continuity of employee protection by providing for the orderly transfer of lockout or tagout device protection between off-going and incoming employees. This will help to minimize exposure to hazards from the unexpected energization or start-up of the machine or equipment or the release of stored energy.

(The Appendix to 1910.147 offers non-mandatory guidelines to help employers and employees in complying with the requirements of this section, as well as to provide other helpful information.)

The Control of Hazardous Energy (Lockout/Tagout)

Safety Training Handout

■ **Why is lockout/tagout training necessary?**

To protect you from the unexpected release of energy while servicing or maintaining equipment in the workplace.

■ **What is lockout/tagout?**

A warning and prevention system that involves:

Lockout – Placing a lock on an energy isolating device to ensure that equipment cannot be turned on while someone is servicing or maintaining it.

Tagout – Placing a tag on an energy isolating device to warn others that someone is working on equipment and it must not be started.

■ **The 5 most common ways that injuries occur during a lockout/tagout are:**

- Failure to shut off equipment.
- Failure to disconnect power source.
- Failure to release stored energy.
- Unexpected restarting of equipment.
- Failure to clear work area before restarting.

■ **Employees can prevent injuries and deaths by:**

- Following all lockout/tagout procedures created for that specific piece of equipment.
- Notifying workers of the lockout/tagout.
- Applying locks/tags to the energy isolating device.
- Verifying machines are safe to be serviced.
- Removing tools and replacing guards after servicing is complete.
- Clearing area of all employees before restarting equipment.
- Never removing another employee's lock or tag.

Lockout/Tagout

Safety Training Handout

Failure to observe proper lockout/tagout techniques – every time – can result in injury or even death. About 10% of serious industrial accidents and about 120 deaths a year occur because of failure to follow lockout/tagout rules.

■ **Lockout/tagout rules are designed to protect workers**

- Many injuries occur because employees don't think they need to shut down a machine or piece of equipment to perform what they consider to be a minor procedure.
- Other injuries occur because employees unknowingly re-start a machine or piece of equipment while another employee is performing maintenance or repairs on it.
- By locking out a machine, an employee ensures that energy sources have been turned off and stored energy has been released.
- Tagging a machine that's been locked out tells everyone not to re-start that machine or piece of equipment.
- Four leading causes of lockout/tagout injuries: failure to properly shut off equipment; equipment unexpectedly restarting; failure to disconnect machine or equipment from power source, and failure to clear the work area during the process.
- Each piece of equipment or machine has its own lockout/tagout procedure that must be followed.

■ **Lockout/tagout affects everyone in the workplace**

- Only authorized employees should perform lockout/tagout.
- The authorized employee must make sure affected workers are aware when a machine or piece of equipment is being shut down.
- Affected employees must be familiar with lockout/tagout procedures.
- Affected employees should never remove a lockout or try to restart a locked/tagged piece of equipment.
- During a group lockout, each worker must attach his or her own lockout/tagout device.
- One employee is charge of maintaining lockout/tagout during a group tagout.




Electrical Safety

Electrical hazards can cause burns, shocks and electrocution (death).

Safety Tips

- Assume that all overhead wires are energized at lethal voltages. Never assume that a wire is safe to touch even if it is down or appears to be insulated.
- Never touch a fallen overhead power line. Call the electric utility company to report fallen electrical lines.
- Stay at least 10 feet (3 meters) away from overhead wires during cleanup and other activities. If working at heights or handling long objects, survey the area before starting work for the presence of overhead wires.
- If an overhead wire falls across your vehicle while you are driving, stay inside the vehicle and continue to drive away from the line. If the engine stalls, do not leave your vehicle. Warn people not to touch the vehicle or the wire. Call or ask someone to call the local electric utility company and emergency services.
- Never operate electrical equipment while you are standing in water.
- Never repair electrical cords or equipment unless qualified and authorized.
- Have a qualified electrician inspect electrical equipment that has gotten wet before energizing it.
- If working in damp locations, inspect electric cords and equipment to ensure that they are in good condition and free of defects, and use a ground-fault circuit interrupter (GFCI).
- Always use caution when working near electricity.

For more complete information:

 **Occupational
Safety and Health
Administration**
U.S. Department of Labor
www.osha.gov (800) 321-OSHA

OSHA 3298-09N-05